REMARKS/ARGUMENTS

Reconsideration and withdrawal of the Examiner's rejection of the above-identified application is respectfully requested in view of the foregoing amendments and following remarks. Claims 16-33 are new and in the application. Claims 1-15 have been canceled.

The Examiner rejected claims 1, 5-11, 14 and 15 under 35 U.S.C. §103(a) as being unpatentable over *Lee et al. U.S. Patent No. 6,419,769* in view of *Schmid et al. U.S. Patent No. 5,178,686* and further in view of the admitted prior art. Claim 2 was rejected under 35 U.S.C. §103(a) as being unpatentable over *Lee et al.* and *Schmid et al.* and the admitted prior art and in further view of *Volume 7 of the 1998 9th Edition ASM Handbook*. Claims 3 and 4 were rejected under 35 U.S.C. §103(a) as being unpatentable over *Lee et al.* and *Schmid et al.* and the admitted prior art and in further view of *Volume 15 of the 1988 9th Edition ASM Handbook*.

This rejection is respectfully traversed.

Applicant has re-written claims 1-11 as new claims 16-26. Claims 27-33 have been added. Support for new claim 27 can be found in original claim 13. Support for the new claim 28 can be found in original claim 1 and in the specification, Example 1. Support for new claim 29 can be found in original claim 1 and in original claim 5. Support for new claim 30 can be found in the specification in Examples 1-3. Support for new claim 31 can be found in the specification in Examples 1-3. Support for new claim 32 can be found in original claim 5. Support for new claim 33 can be found in original claims 1, 2, 3 and 7.

Lee shows an aluminum alloy, comprising the following elements, by weight percent (wt %): silicon 11.0-14.0; copper 5.6-8.0; magnesium 0.5-1.5 and further small amounts of iron, nickel, manganese, titanium, zirconium, vanadium and strontium. Lee describes a method for producing the alloy, comprising a first step of gravity casting at about 1325°F to 1450°F (718.3°C-787.78°C). Through gravity casting, an article consisting of the alloy is produced without the aid of pressure such as squeeze casting, pressure casting or dry casting. The cast article is further solutionized at a temperature of 900°F to 1,000°F (482.2°C-537.78°C). Further, the article is quenched at a temperature between 120°F to 300°F (48.8°C-148.89°C) and in a

last step, the article is aged at temperatures ranging from 425°F to 485°F (218.3°C–248.9°C).

Lee does not teach an alloy having a composition as claimed in the present invention, since in particular the copper content is completely different. Lee also does not teach a step of hot-forming prior to the heat treatment step and subsequent to the casting.

Lee explicitly states that the addition of significantly higher levels of magnesium would lead to a disadvantageous composition of the alloy (column 4, lines 1 to 3). Further, Lee teaches to keep the ratio of silicon to magnesium in a range between 10 to 25, so that the intermetallic compound magnesium silicide forms only a minor strengthening phase. Therefore, Lee teaches away from using a high weight percentage of magnesium in the alloy.

Schmid shows an aluminum base alloy, comprising 5-25 wt.-% magnesium silicide as a primary addition. Scbmid proposes to add up to 12 wt.-% silicon or up to 15 wt.-% magnesium as a secondary addition. Schmid et al. teach that the liquidous temperature of the tertionary system aluminum-magnesium-silicon is below 700°C.

An article made of the alloy is produced by conventional casting. During the casting process, the magnesium silicide or magnesium and silicon separately are added.

As to be clearly taken from col. 2, li. 48-56, the secondary addition intends to achieve ductility of the material, which is the opposite of a high-strength material as claimed. One can further deduce from the cited passage, that up to 12 wt.-% Si addition can be replaced by up to 15 wt-% Mg, i.e. in a ratio of about 1.2. As these two secondary additions may replace each other, they cannot be present in maximum concentrations at the same time.

Schmid does not teach that an excess of Mg is mandatory; to the contrary, the teaching is that Mg can easily be replaced by Si, achieving similar properties. Schmid does not teach that at least 1.0 wt.-% of Cu must be provided. Schmid also does not teach a hot-forming step, and further does not teach a heat treatment step. Also, no suggestions of which specific casting method should be used are given.

Volume 7 of the 1998 9th Edition ASM Handbook teaches a method of spray compacting and suggests production of aluminum

alloys using a method of spray compacting. Volume 7 does not teach an alloy having the claimed composition.

Volume 7 does not suggest or teach further steps for processing the spray compacted alloy. Therefore, Lee et al. in view of Volume 7 of the 1998 9th Edition ASM Handbook do not suggest to a person of ordinary skill in the art to provide a hot-forming step between the casting and the heat treatment. Volume 7 finally does not teach a specific heat treatment.

Volume 15 of the 1988 9th Edition ASM Handbook teaches methods of continuous casting and chill casting. Volume 15 does not teach an alloy having the claimed composition. Further, Volume 15 does not suggest any further steps for further processing the cast materials. In fact, Volume 15 suggests the possibility of heat treatment directly after the casting process step. Thus, Volume 15 teaches away from a hot forming step, which is omitted herein, according to claim 1 of the application. Volume 15 finally does not teach a specific heat treatment.

Volume 14 of the 1988 9th Edition ASM Handbook - forging of aluminum alloys- teaches a variety of forging methods of aluminum alloys. Volume 14 also suggests a combination of more than one

forging method. Volume 14 does not teach an alloy having the claimed composition. Furthermore, Volume 14 does not teach to forge the alloy in a step preceding the heat treatment step.

In the rejections of the claims, the Examiners combines:

a) the extremely broad range of alloy composition of Schmid, presumably overlapping with the alloy of the block as claimed;

b) the disclosure of Volume 14 presumably showing the claimed hot-forming step;

c) the heat treatment step as to be shown in Lee.

Applicant respectfully traverses. It is not acceptable to combine isolated elements of cited references without reason to combine them, nor is the claimed method a simple addition of isolated steps, but rather each step is performed in a given sequence.

The Examiner does not mention the fact that another step of heat treatment is being carried out after the hot-forming step to gain the desired alloy with the desired properties.

Further, regarding the statement of the Examiner about paragraph 3 on page 5 of the instant specification, it is explicitly not admitted that performing hot forming methods on the base alloy before a heat treatment is prior art; only that the hot forming methods, i.e. extrusions, hot rolling or forging, are well-known in the prior art for themselves.

Furthermore, since no suggestion is given in any of the above-mentioned documents to produce the alloy in a first step, hot-form it in a second step and heat treat it in a third step, a person ordinarily skilled in the art would not find nor use a method taught in claim 1 of the application in the prior art.

Moreover a person ordinarily skilled in the art would not combine Lee et al. with Schmid et al. as laid out above and therefore, Lee in view of Schmid cannot be held against any claim of the application.

It is not a matter of routine to produce an high-strength material including the claimed steps, because the steps disclosed in Schmid transform the alloy block, and unpredictable properties of the material arise.

Moreover, the teaching of the claimed invention is not to select a range from Schmid, but rather a very specific, narrow range, where Schmid includes no indication of this particular range having specific properties.

Furthermore, Schmid mentions a very broad range of aluminum alloys including an addition of magnesium, in this case it is suggested to add an amount of 5 to 12 wt.-% of magnesium to the alloy. This teaches away from the invention, since as one can easily grasp the addition of magnesium according to the examples in the invention ranges from 2.1 (example 2) to 3.2 (example 1), which is a much lower amount for a secondary additional component.

A skilled person combining the teaching of Lee of a high amount of silicon and the teaching of Schmid of a preferably high amount of silicon would avoid the alternate solution of Schmid to replace silicon by magnesium, but rather might overweight silicon. Accordingly, when combining these two references, a skilled person would not consider the claimed specific Si/Mg ratio.

Lee teaches away from a high level of magnesium in the aluminum alloy, Lee et al. also teaches away from the alloy disclosed by Schmid. Schmid does not give any suggestion as to further process the cast alloy. Therefore, it would not be obvious to a person ordinarily skilled in the art to combine the teachings of Schmid with the teachings of US' 769.

Accordingly, the rejection of the independent claim(s) should be withdrawn.

Regarding original claim 5, the Examiner states that it would have been obvious to one of ordinary skill in the art that the additional silicon taught in Schmid is a functional equivalent to the magnesium phosphate of the instant inventions, since it performs the same function, which is the increae of grain fineness. "In order to rely on equivalence as a rational supporting an obviousness rejection, the equivalency must be recognised in the prior art, and cannot be based on applicants disclosure or the near fact that the components at issue are functional mechanical equivalence" (see MPEP 2144.06 II) and since Schmid does not teach that magnesium phosphate is an equivalent to an addition of up to 12 wt-% of silicon, the magnesium phosphate would not have been obvious to one of

ordinary skill in the art as being of the same function of increasing grain fineness.

As set forth in new claim 16, Applicant claims a method for the production of a material, whereby an aluminum-based alloy having a content of 5.5 to 13.0 mass-% silicon and a content of magnesium according to the formula

$$Mg\ [\text{mass-}\%] = 1.73 \times Si\ [\text{mass-}\%] + m$$

where m = 1.5 to 6.0 mass-% magnesium

as well as having a copper content between 1.0 and 4.0 mass-% is produced, the base alloy subsequently undergoes hot-forming at least once, and is then subsequently subjected to a heat treatment consisting of solution heat treatment, quenching, and artificial aging.

None of the references cited taken singly or in combination discloses or suggests a method of producing a material with a composition according to the formula provided above, performing hot-forming on the material or base alloy, and then performing a heat treatment on the base alloy including a solution heat treatment, a quenching, and an artificial aging.

Lee et al. does not disclose performing a hot-forming, for example extrusion, hot-rolling or forging, on a material or base alloy that has been produced. As indicated in the First Office Action, *Lee et al.* discloses performing a solution heat treatment, a quenching and an artificial aging on article formed from an alloy (see *Lee et al.* at column 4 lines 50-61). The article, such as an engine block or a piston, is processed using conventional gravity casting (see *Lee et al.* at column 4 lines 40-41 and 50-51). Applicant's method as claimed in claim 16 includes performing a series of heat treatments only on a base alloy or material that has undergone a hot-forming and not on an article produced from gravity casting.

The hot-forming and subsequent heat treatments will often be performed on a base alloy in the form of a cylindrical block (see Example 1 of spec on pg. 6). Applicant's invented method as claimed in claim 16 does not include performing a series of heat treatments on an engine block or piston formed from gravity casting.

Although the Examiner considered the gravity casting disclosed in *Lee et al.* to meet the limitation of Applicant's claim 1 of the base alloy being subsequently heat-formed, it is

respectfully submitted that the hot-forming claimed in claim 16, that is now amended for purposes of correcting errors in translation, does not include conventional gravity casting. The hot-forming claimed in claim 16 refers to processes such as extrusion, hot rolling, and forging that work with solid materials, and not conventional gravity casting that deals with a liquid material. See Applicant's specification on pg. 5, paragraph 3.

This failure of the *Lee et al.* reference to disclose all of the steps of Applicant's invented method as claimed in claim 16 is nowhere remedied by the secondary reference to *Schmid et al.*, which does not disclose any post-production steps for treating lightweight cast material. Applicant's invented method as claimed in claim 16 would thereby not be obvious to one of skill in the art in view of the *Lee et al.* and *Schmid et al.* references.

The Examiner looks to Applicant's own specification to support the argument that it would have been obvious to one of skill in the art to perform extrusion, hot rolling, or forging on the base alloy produced (see Examiner's rejection of claim 6). It is respectfully submitted that it is not obvious to perform

such a hot-forming on a material produced with the composition of the formula found in Applicant's claim 16, and to thereafter perform additional heat treatment steps on the material. The *Schmid et al.* reference cites the *Mondolfo* publication which teaches that aluminum alloys with more than 2% by weight magnesium silicide have problems with deformation (Col. 2 lines 41-47). Applicant's method of producing an aluminum alloy includes adding far more than 2% by weight of magnesium silicide, and is still sufficiently deformable to undergo a subsequent hot-forming.

Applicant's invented method as recited in claim 16 can include adding up to 35% by weight magnesium silicide. Additionally, because magnesium is added in Applicant's process always in excess to the silicon that reacts with magnesium to form magnesium silicide, there is no excess silicon in the material produced by the Applicant's method. Thereby no ternary Al-Mg_2Si-Si eutectic alloy is formed, as can be formed in the lightweight cast material disclosed in *Schmid et al.* Applicant's inventive method produces an aluminum alloy material with a unique chemical composition resulting in a unique combination of properties including superior fatigue resistance and superior performance on static and dynamic tests. These properties are

not found in the aluminum alloys of the prior art that are especially suitable for piston production (see charts on pgs. 9 and 10 of the specification).

As the prior art references taken singly or in combination do not disclose Applicant's invented method as found in claims 16-33, it is respectfully submitted that the claims are patentable and allowable over the cited references.

In summary, claims 1-15 have been canceled, and new claims 16-33 have been added. In view of the foregoing, it is respectfully requested that the claims be allowed and that this application be passed to issue.

Respectfully submitted,
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I hereby certify that this correspondence is being filed electronically in the U.S. Patent and Trademark Office on September 4, 2009.

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